WASTEWATER TREATMENT
CONVERSION FACTORS AND FORMULAS

CONVERSION TABLE

AREA

1 Acre	= 43,560 Sq Ft
1 Sq Ft	= 144 Sq Inches
1 Sq Mile	= 640 Acres

FLOW

1 MGD	= 694 GPM
1 MGD	= 11.57 GPS
1 MGD	= 1.55 CFS
1 MGD	= 43,800 Liters/Sec

LENGTH

1 Inch	= 2.54 Centimeters
1 Foot	= 12 Inches
1 Meter	= 3.28 Ft
1 Yard	= 3 Ft
1 Mile	= 5,280 Ft
1 Mile	= 1,760 Yds

POWER

1 Btu	= 778.3 Ft Lbs
1 kWh	= 3,413 Btu's
1 hp	= 0.7457 Kilowatts
1 hp	= 42.44 Btu/Min
1 hp	= 746 Watts
1 hp	= 33,000 Ft Lbs/Min
1 hp	= 550 Ft Lbs/Sec

PRESSURE

1 psi	= 2.31 Feet
1 Ft Water	= 0.433 psi
1 psi	= 2.036 Inches Mercury
1 Inch Mercury	= 0.4912 psi

TEMPERATURE

°F	= (°C X 1.8) + 32
°C	= (°F – 32) ÷ 1.8

TIME

1 Minute	= 60 Seconds
1 Hour	= 60 Minutes
1 Day	= 24 Hours
1 Day	= 1,440 Minutes

VOLUME

1 Quart	= 946 ml
1 Gallon	= 3,785 ml
1 Gallon	= 3.785 Liters
1 Gallon	= 0.13368 Cu Ft
1 Cu Ft	= 7.48 Gallons
1 Cu Ft	= 28.32 Liters
1 Cu Yd	= 27 Cu Ft
1 Liter	= 1.06 Quarts
1 Liter	= 0.2642 Gallons
1 Liter	= 1,000 Milliliters
1 Acre Ft	= 325,851 Gallons

WEIGHT

1 ml Water	= 1 Gram
1 Gram	= 1,000 Milligrams
1 Ounce	= 28.35 Grams
1 Pound	= 7,000 Grains
1 Gal. Water	= 8.34 Pounds
1 Cu Ft Water	= 62.4 Pounds
1 Ton	= 2,000 Pounds

AREA (SQ FT)

Circle	$(\pi)(\text{Radius})^2$ or $(0.785)(\text{Diameter})^2$
Cone	n/a
Cube	n/a
Cylinder	n/a
Pyramid	n/a
Rectangle	(Length)(Width)
Sphere	n/a
Square	(Length)(Width)
Triangle	½ (Base)(Height)

Circumference = $(\pi)(\text{Diameter})$
$\pi = 3.14$

VOLUME (CU FT)

n/a
$\frac{1}{3}(\text{Diameter})^2(\text{Depth})(0.785)$
(Length)(Width)(Height)
$(\pi)(\text{Radius})^2(\text{Height})$ or $(0.785)(\text{Diameter})^2(\text{Height})$
$\frac{1}{3}$(Height)(Base Area)
(Length)(Width)(Height)
$^4/_3(\pi)(\text{Radius})^3$ or $(0.5236)(\text{Diameter})^3$
(Length)(Width)(Height)
½(Base X Height X Length)

BASIC FORMULAS

Pounds of BOD or TSS = Flow, MGD X Concentration, mg/l X 8.34

BOD, mg/l = (Initial DO-Final DO) X BOD $\frac{\text{Bottle Vol, ml}}{\text{Sample, ml}}$

Population Equivalent = $\frac{\text{Lbs of BOD in Raw Influent/ Day}}{\text{0.17 Lbs,BOD/ Person/ Day}}$

Detention Time (Hours) = $\frac{\text{(Tank Volume, Cu Ft) (7.48 Gal/Cu Ft) 24 Hr/Day}}{\text{Flow, Gal Per Day}}$

Detention Time (Days) = $\frac{\text{Volume, MG}}{\text{Flow, MGD}}$

F/M Ratio = $\frac{\text{Lbs BOD in Influent/Day}}{\text{Lbs MLVSS in Aeration Tank}}$

Or = $\frac{\text{BOD, mg/l X Flow, MGD X 8.34}}{\text{MLVSS, mg/l X Vol in Aeration Tank, MG X 8.34}}$

Hydraulic Loading or Surface Loading, GPD/Sq Ft = $\frac{\text{Flow, GPD}}{\text{Surface Area, Sq Ft}}$

Aerator Loading, Lbs/BOD,Day = Flow, MGD X BOD, mg/l X 8.34

Organic Loading, Activated Sludge = $\frac{\text{Flow, MGD X BOD, mg/l X 8.34}}{\text{Volume in A.T., 1,000 Cu Ft}}$

Organic Loading, Tr. Filter = $\frac{\text{Flow, MGD X BOD, mg/l X 8.34}}{\text{Volume of Filter Media, 1,000 Cu Ft}}$

Organic Loading, RBC = $\frac{\text{Soluble BOD, Applied Lbs/Day}}{\text{Surface Area of Media, 1,000 Sq Ft}}$

M.C.R.T., Days = $\frac{\text{Lbs, MLSS in Secondary System}}{\text{Lbs/Day SS Wasted + Lbs/ Day SS in Effluent}}$

Weir Overflow Rate, GPD/ft = $\frac{\text{Flow, GPD}}{\text{Length of Weir, Ft}}$

Oxygen Uptake Rate (OUR) mg O_2/l/Hour = $\frac{\text{(DO1, mg/l – DO2, mg/l)}}{\text{(Time2, Min) – (Time1, Min)}}$ X 60 Min/Hour

Respiration Rate (RR) mg O_2/Hour/Gm = $\frac{O_2 \text{ Uptake, mg/l/Hour X 1000 mg/gm}}{\text{MLSS, mg/l}}$

PONDS

Population Loading, Person/Acre = $\frac{\text{Population Served,Persons}}{\text{Pond Surface Area, Acres}}$

Organic Loading, Lbs, BOD/Day/Acre = $\frac{\text{(Flow,MGD)(BOD,mg/l)(8.34)}}{\text{Area, Acres}}$

BASIC FORMULAS
SLUDGE AND SOLIDS

Suspended Solids, mg/l = $\frac{\text{(W2) – (W1)}}{\text{ml Sample}}$ X 1000 X 1000

Volatile Suspended Solids, mg/l = $\frac{\text{(W2) – (W3)}}{\text{ml Sample}}$ X 1000 X 1000

Where W1 (Dish), W2 (Dish and Dry Solids), W3 (Dish and Ash)

Volatile Solids, Lbs = $\frac{\text{Dry Solids, Lbs X Raw Sludge, \% VS}}{\text{100\%}}$

Aerator Solids, Lbs = Tank Vol, MG X MLSS, mg/l X 8.34

Solids Applied, Lbs/Day = (Flow, MGD + RSF, MGD)(MLSS, mg/l X 8.34)

Solids Loading, Lbs/Day/Sq Ft = $\frac{\text{Solids Applied, Lbs/Day}}{\text{Surface Area, Sq Ft}}$

Sludge Volume Index (SVI), ml/gm = $\frac{SSV_{30}\text{, ml/l X 1000 mg/g}}{\text{MLSS, mg/l}}$

Sludge Age = $\frac{\text{Lbs TSS in Aeration Basin}}{\text{Lbs/Day TSS in Influent}}$

Reduction of Volatile Solids, % = $\frac{\text{In – Out}}{\text{In – (In X Out)}}$ X 100

Percent Removal = $\frac{\text{Inf – Eff}}{\text{Inf}}$ X 100

Dry Solids, Lbs = $\frac{\text{Raw Sludge, Gal X Raw Sludge, \% X 8.34}}{\text{100\%}}$

Return Sludge Rate, MGD = $\frac{\text{(Total Flow, MGD)(Settleable Solids, \%)}}{\text{100\%}}$

Digester Loading, Lbs/Day/Cu Ft = $\frac{\text{VS Added, Lbs/Day}}{\text{Digester Vol, Cu Ft}}$

CONCENTRATIONS AND SOLUTIONS

1 mg/l	= 1 ppm
1 mg/l	= 8.34 Lbs/ Million Gal
Lbs, Chemical	= $\frac{\text{Desired ppm X Flow, MGD X 8.34}}{\text{\% Purity of Chemical}}$
1 Mole	= 1 Gram Molecular Weight per Liter of Solution
1 Normal	= 1 Gram Equivalent Weight per Liter of Solution
ppm	= $\frac{\text{Lbs Chemical Fed}}{\text{MGD X 8.34}}$
1 % Solution	= 10,000 mg/l